

Surface Tension and Viscosity of Commercial Ni- and Ti-Alloys: Results of the ThermoLab Project

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The surface tension and viscosity are important thermophysical properties in the modelling of industrial casting processes. Because of the high liquidus temperature and chemical reactivity in the liquid phase of many industrial alloys, experimental values of these properties are often unreliable.

The ThermoLab project is concerned with the measurement of thermophysical properties of industrial alloys. The eventual goal of this effort is to perform benchmark experiments under reduced gravity conditions on board the International Space Station. Here, we report on measurements of the surface tension and viscosity of commercial Ti-alloys including Ti₆Al₄V and of the Ni-base superalloy CMSX-4. Measurements have been performed by the sessile drop, the pendent drop and the oscillating drop technique in an electromagnetic levitation device. The latter have been performed in a ground-based laboratory and during the reduced gravity phase of a parabolic flight. Results obtained with the different techniques will be critically compared. For both classes of alloys, the value of the surface tension is smaller than a weighted average of the individual components, indicating that the surface tension is determined by the presence of surface active elements such as Al rather than by the refractories. This notion is supported by results of a model calculation of surface segregation in the Ni-Al system which was taken as a first step approach to the CMSX-4 Ni-base superalloy.